

PATENT

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Claims:

1. A differential pressure sensor, comprising:
 - a pressure sensing element formed by encasing an optical waveguide in an elastically deformable medium;
 - a plate coupled with the pressure sensing element;
 - bellows attached to the plate, wherein the pressure sensing element is located at least partially within the bellows; and
 - a housing surrounding the plate and bellows, the housing having a first port to receive a first pressure directed to the first face of the plate and a second port to receive a second pressure directed to a second opposing face of the plate from within the bellows to provide movement to the plate, wherein the pressure sensing element is responsive to the movement of the plate.
2. The differential pressure sensor of claim 1, wherein the pressure sensing element comprises a Bragg grating.
3. The differential pressure sensor of claim 1, wherein the elastically deformable medium comprises a tube fused to the optical waveguide.
4. The differential pressure sensor of claim 1, wherein the elastically deformable medium inwardly tapers away from the optical waveguide at each end.
5. The differential pressure sensor of claim 1, wherein the elastically deformable medium comprises a first portion having a smaller outside diameter than two second portions disposed at each end of the first portion.
6. The differential pressure sensor of claim 1, further comprising a second pressure sensing element along the optical wave guide disposed outside of the bellows.

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7. The differential pressure sensor of claim 1, further comprising means for retaining the plate and bellows within the housing.
8. The differential pressure sensor of claim 1, wherein at least a portion of the housing is affixed to or contiguous with the plate and bellows.
9. A differential pressure sensor, comprising:
 - a chamber defined by a housing having walls for receiving a first pressure directed to a first surface of at least one of the walls to provide a deflection of the at least one wall;
 - a port through the housing to receive a second pressure directed to a second surface of the at least one wall, wherein the second pressure opposes the deflection of the at least one wall; and
 - a pressure sensing element formed by encasing an optical waveguide in an elastically deformable tube, wherein the pressure sensing element is coupled to at least a portion of the at least one wall within the chamber and is responsive to the deflection thereof.
10. The differential pressure sensor of claim 9, wherein the elastically deformable tube is fused to the optical waveguide.
11. The differential pressure sensor of claim 9, wherein the elastically deformable tube comprises a first portion having a smaller outside diameter than two second portions disposed at each end of the first portion.
12. The differential pressure sensor of claim 9, wherein the pressure sensing element comprises a Bragg grating.
13. The differential pressure sensor of claim 9, wherein at least a portion of the at least one wall comprises a diaphragm.

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14. The differential pressure sensor of claim 9, wherein at least one piston couples the pressure sensing element to the at least a portion of the at least one wall.
15. A differential pressure sensor, comprising:
 - a member for receiving a first pressure directed to a first face of the member and a second pressure directed to a second face of the member to provide a movement to the member; and
 - a pressure sensing element formed by encasing an optical waveguide in an elastically deformable tube having a first portion with a smaller outside diameter than two second portions disposed at each end of the first portion, wherein the pressure sensing element is coupled to the member and is responsive to the movement.
16. The differential pressure sensor of claim 15, wherein the pressure sensing element comprises a Bragg grating.
17. The differential pressure sensor of claim 16, wherein a characteristic frequency of light reflected from the Bragg grating varies in response to the movement.
18. The differential pressure sensor of claim 15, further comprising a temperature sensor in the optical waveguide.
19. The differential pressure sensor of claim 18, wherein the temperature sensor is located at one of the second portions.
20. The differential pressure sensor of claim 18, wherein the temperature sensor is located in a third portion of the elastically deformable tube that extends axially from one of the second portions.